

Turning Plastic Bags into Nanotubes for Batteries

Plastic bags have taken over the grocery market since they were first introduced more than 30 years ago. Billions of them are used around the world each year. The bags are recyclable, but a majority of them still end up in landfills.

The Challenge

Plastic grocery bags are made of polyethylene, which is non-biodegradable and made from nonrenewable resources (crude oil and natural gas). They can take hundreds of years to decompose in landfills and are one of the most challenging items for the recycling industry to manage.

The Solution

Argonne scientists have discovered a way to convert plastic bags into carbon nanotubes, a substance that can be used as anode material in advanced batteries such as lithium-ion and eventually lithium-air batteries.

The groundbreaking process involves heating the plastic material in a reactor with a cobalt catalyst to 700° C and then allowing it cool. Researchers found that the chemical bonds within the plastic completely broke down, causing the carbon in the plastic to grow as nanotubes on the cobalt particles.

The Results

The Argonne-developed technology is one of the cheapest and most environmentally friendly ways to grow nanotubes yet to be discovered. It could potentially result in less-expensive batteries, while lessening the amount of waste going into landfills. This process, which can also be used for other types of plastics, is now available for licensing to potential industry partners.



Chemist Vilas Pol places a plastic bag into a specially designed reactor in the presence of a cobalt acetate catalyst to start the process.



The resulting carbon nanotubes can be used as the anode material in lithium-ion batteries.

"We have used the as-prepared cobalt-encapsulated carbon nanotubes as an anode material for lithium-ion batteries and they work fantastically," said Vilas Pol, Argonne Scholar, Argonne National Laboratory. "The specific capacity of these carbon nanotubes is higher than commercial nanotubes."